moon, the Moon at C, the Earth at c, *Mars* will be ſeen at γ, its true place, as if the Earth were at T. But then, after the Full, the Moon at D, the Earth at d; *Mars* will be ſeen, not at γ, but at δ; too forward: and yet more, when the Moon (at the laſt Quarter) is at E, the Earth at e, and *Mars* ſeen at ε. If therefore *Mars* (when in oppoſition to the Sun) be found (all other allowances being made) ſomewhat too backward before the Full moon, and ſomewhat too forward after the Full-moon, (and moſt of all, at the Quadratures:) it will be the beſt confirmation of the Hypotheſis. (The like may be fitted to *Mars* in other poſitions, *mutatis mutandis*; and ſo for the other Planets.)

But this proof, is of like nature as that of the Parallaxis of the Earths Annual Orb to prove the Copernican Hypotheſis. If it can be obſerved, it proves the Affirmative; but if it cannot be obſerved, it doth not convince the Negative, but only proves that the Semidiameter of the Earths Epicycle is ſo ſmall as not to make any diſcernable Parallax. And indeed, I doubt, that will be the iſſue. For the Semidiameter of this Epicycle, being little more than the Semidiameter of the Earth it ſelf, or about $1\frac{1}{3}$ thereof (as is conjectured, in the *Hypotheſis*, from the Magnitudes and Diſtances of the Earth and Moon compared;) and there having not as yet been obſerved any diſcernable *Parallax* of *Mars*, even in his neereſt poſition to the Earth; it is very ſuſpicious, that here it may prove ſo too. And whether any of the other Planets will be more favourable in this point, I cannot ſay.

ANIMADVERSIONS

Of Dr. Wallis, *upon Mr.* Hobs's *late Book*, De Principiis & Ratiocinatione Geometrarum.

Theſe were communicated by way of Letter, written in *Oxford*, July 24. 1666. to an Acquaintance of the *Author*, as follows:

SInce I ſaw you laſt, I have read over Mr. *Hobs*'s Book *Contra Geometras* (or *De Principiis & Ratiocinatione Geometrarum*) which you then ſhewed me. A *New* Book of *Old* matter: Containing but a *Repetition* of what he had before told us, more than once; and which hath been Anſwered long agoe.

In which, though there be Faults enough to offer ample matter for a large Confutation: yet I am ſcarce inclined to believe, that any will beſtow ſo much pains upon it. For, if that be true, which (in his *Preface*) he ſaith of himſelf, *Aut ſolus inſanio Ego, aut ſolus non inſanio:* it would either be *Needleſs*, or *to no Purpoſe*. For, by his own confeſſion, *All others*, if they be not mad themſelves, ought to think *Him* ſo: And therefore, as to *Them*, a Confutation would be *needleſs;* who, its like, are well enough ſatisfied already: at leaſt out of danger of being ſeduced. And, as to himſelf, it would be *to no purpoſe*. For, if *He* be the Mad man, it is not to be hoped that he will be convinced by Reaſon: Or, if *All We* be ſo; we are in no capacity to attempt it.

But there is yet another Reaſon, why I think it not to need a Confutation. Becauſe what is in it, hath been ſufficiently confuted already; (and, ſo Effectually; as that he profeſſeth himſelf not to Hope, that *This Age* is like to give ſentence for him; what ever *Nondum imbuta Poſteritas* may do.) Nor doth there appear any Reaſon, why he ſhould again Repeat it, unleſs he can hope, That, what was at firſt Falſe, may by oft Repeating, become True.

I ſhall therefore, inſtead of a large Anſwer, onely give you a brief Account, *what is in it*; &, *where it hath been already Anſwered.*

The chief of what he hath to ſay, in his firſt 10 Chapters, againſt *Euclids* Definitions, amounts but to this, That he thinks, *Euclide* ought to have allowed his *Point* ſome *Bigneſs*; his *Line*, ſome *Breadth*; and his *Surface*, ſome *Thickneſs*.

But where in his *Dialogues*, pag. 151, 152. he ſolemnly undertakes to Demonſtrate it; (for it is there, his 41th *Propoſition:*) his Demonſtration amounts to no more but this; That, *unleſs a Line be allowed ſome Latitude; it is not poſſible that his Quadratures can be True.* For finding himſelf reduced to theſe inconveniences; 1. That his *Geometrical Conſtructions*, would not conſiſt with *Arithmetical calculations*, nor with what *Archimedes* and others have long ſince demonſtrated: 2. That the *Arch* of a Circle muſt be allowed to be ſometimes *Shorter* than its *Chord*, and ſometimes *longer* than its *Tangent*: 3. That the ſame Straight Line muſt be allowed, at one place onely to *Touch*, and at another place to *Cut* the ſame Circle: (with others of like nature;) He findes it neceſſary, that theſe things may not ſeem Abſurd, to allow his *Lines* ſome *Breadth*, (that ſo, as he ſpeaks, *While a Sraight Line with its Out-ſide doth at one place*

Touch

Touch the Circle, it may with its In-ſide at another place Cut it, &c.) But I ſhould ſooner take this to be a *Confutation of His Quadratures*, than a *Demonſtration of the Breadth of a*(Mathematical) *Line*. Of which, ſee my *Hobbius Heauton-timorumenus*, from *pag.* 114. to *p.* 119.

And what he now Adds, being to this purpoſe; That though *Euclid's* Σημεῖον, which we tranſlate, *a Point*, be not indeed *Nomen Quanti*; yet cannot this be actually repreſented by any thing, but what will have ſome Magnitude; nor can *a Painter*, no not *Apelles* himſelf, draw a *Line* ſo ſmall, but that it will have ſome Breadth; nor can *Thread* be ſpun ſo Fine, but that it will have ſome Bigneſs; (*pag.* 2, 3, 19, 21.) is nothing to the Buſineſs; For *Euclide* doth not ſpeak either of ſuch *Points*, or of ſuch *Lines*.

He ſhould rather have conſidered of his own Expedient. *pag.* 11. That, when one of his (*broad*) Lines, paſſing through one of his(*great*) Points, is ſuppoſed to cut another Line propoſed, into two equal parts; we are to underſtand, the *Middle of the breadth* of that Line, paſſing through the *middle* of that Point, to diſtinguiſh the Line given into two equal parts. And he ſhould then have conſidered further, that *Euclide*, by a *Line*, means no more than what Mr. *Hobs* would call *the middle of the breadth* of his; and *Euclide's Point*, is but the *Middle* of Mr. *Hobs's*. And then, for the ſame reaſon, that Mr. *Hobs's Middle* muſt be ſaid to have no *Magnitude*; (For elſe, not the *whole Middle*, but the *Middle of the Middle*, will be *in the Middle*: And, the *Whole* will not be equal to its *Two Halves*; but Bigger than *Both*, by ſo much as the *Middle* comes to:) *Euclide's Lines* muſt as well be ſaid to have no Breadth; and his *Points* no Bigneſs.

In like manner, When *Euclide* and others do make the *Terme* or *End* of a Line, a *Point*: If this *Point* have *Parts* or *Greatneſs*, then not the *Point*, but the *Outer-Half* of this Point ends the Line, (for, that the *Inner-Half* of that Point is not at the End, is manifeſt, becauſe the *Outer-Half* is beyond it:) And again, if that *Outer Half* have *Parts* alſo; not this, but the *Outer* part of it, and again the *Outer part* of that *Outer part*, (and ſo in *infinitum*.) So that, as long as *Any thing of Line* remains, we are not yet at the *End*: And conſequently, if we muſt have paſſed the *whole Length*, before we be at the *End*; then that *End* (or *Punctum terminans*) has *nothing of Length*; (for, when the *whole Length* is paſt, there is nothing of it left. And if Mr. *Hobs* tells us (as *pag.* 3.) that this *End*

End is not *Punctum*, but only *Signum* (which he does allow *non eſſe nomen Quanti*) even *this* will ſerve our turn well enough. *Euclid*'s Σημεῖον, which ſome Interpreters render by *Signum*, others have thought fit (with *Tully*) to call *Punctum*: But if Mr. *Hobs* like not that name, we will not contend about it. Let it be *Punctum*, or let it be *Signum* (or, if he pleaſe, he may call it *Vexillum*.) But then he is to remember, that this is only a Controverſie in *Grammar*, not in *Mathematicks*: And his Book ſhould have been intituled *Contra Grammaticos*, not, *Contra Geometras*. Nor is it *Euclide*, but *Cicero*, that is concern'd, in rendring the Greek Σημεῖον, by the Latine *Punctum*, not by Mr. *Hobs's Signum*. The Mathematician is equally content with either word.

What he ſaith here, *Chap*.8.& 19. (and in his fifth *Dial.p*.105. &c.) concerning the *Angle of Contact*; amounts but to thus much, That, by the *Angle of Contact*, he doth not mean either what *Euclide* calls an *Angle*, or any thing of that kind; (and therefore ſays nothing to the purpoſe of what was in controverſie between *Clavius* and *Peletarius*, when he ſays, that *An Angle of Contact hath ſome magnitude*:) But, that by the *Angle of Contact*, he underſtands the *Crookedneſs of the Arch*; and in ſaying, *the Angle of Contact hath ſome magnitude*, his meaning is, that the *Arch of a Circle hath ſome crookedneſs*, or, is a *crooked line*: and that, of equal Arches, That is the more crooked, whoſe chord is ſhorteſt: which I think none will deny; (for who ever doubted, but that *a circular Arch is crooked*? or, that, of ſuch Arches, equal in length, *That is the more crooked, whoſe ends by bowing are brought neareſt together*?) But, why the *Crookedneſs of an Arch*, ſhould be called *an Angle of Contact*; I know no other reaſon, but, becauſe Mr. *Hobs* loves to call that *Chalk*, which others call *Cheeſe*. Of this ſee my *Hobbius Heauton-timorumenus*, from *pag*. 88. to *p*. 100.

What he ſaith here of *Rations* or *Proportions*, and their *Calculus*; for 8. Chapters together, (*Chap*. 11. &c,) is but the ſame for ſubſtance, what he had formerly ſaid in his 4th. Dialogue, and elſewhere. To which you may ſee a full Anſwer, in my *Hobbius Heauton-tim*. from *pag* 49. to *p*. 88. which I need not here repeat.

Onely (as a *Specimen* of Mr. *Hobs's* Candour, in Falſifications) you may by the way obſerve, how he deals with a Demonſtration of Mr. *Rook's*, in confutation of Mr. *Hobs's* Duplication of the Cube: Which when he had repeated, *pag*. 43. He doth then (that it might ſeem abſurd) change thoſe words, *æquales*

quatuor

quatuor cubis DV ; (*pag.* 43. *line* 33.) into theſe (*p.* 44. *l.* 5.) *æqualia quatuor Lineis, nempe quadruplus Rectæ* DV: And would thence perſwade you, that Mr. *Rook* had aſſigned a *Solide*, equal to a *Line*. But Mr. *Rook's* Demonſtration was clear enough for Mr. *Hobſe's* Comment. Nor do I know any Mathematician (unleſs you take *Mr. Hobs* to be one) who thinks that *a Line multiplyed by a Number will make a Square*; (what ever *Mr. Hobs* is pleaſed to teach us.) But, That *a Number multiplyed by a Number, may make a Square Number*; and, That *a Line drawn into a Line may make a ſquare Figure, Mr. Hobs* (if he were, what he would be thought to be) might have known before now. Or, (if he had not before known it) he might have learned, (by what I ſhew him upon a like occaſion, in my *Hob. Heaut. pag.* 142. 143. 144.) *How* to underſtand that Language, without an Abſurdity.

Juſt in the ſame manner he doth, in the next page, deal with *Clavius*. For having given us his words, pag. 45 l. 3. 4. *Dico hanc Lineam Perpendicularem extra circulum cadere* (becauſe neither *intra Circulum*, nor *in Peripheria*;) He doth, when he would ſhew an errour, firſt make one, by falſifying his words, *line* 15. where inſtead of *Lineam Perpendicularem*, he ſubſtitutes *Punctum A*. As if *Euclide* or *Clavius* had denyed the *Point A*. (the utmoſt point of the *Radius*,) to be in the Circumference: Or, as if Mr. *Hobs*, by proving the *Point A*, to be in the Circumference, had thereby proved, that the *Perpendicular Tangent A E* had alſo lyen in the Circumference of the Circle. But this is a Trade, which Mr. *Hobs* doth drive ſo often, as if he were as well faulty in his *Morals*, as in his *Mathematicks*.

The *Quadrature of a Circle*, which here he gives us, *Chap.* 20. 21. 23. is one of thoſe *Twelve* of his, which in my *Hobbius Heauton-timorumenus* (from *pag.* 104. to *pag.* 119) are already confuted: And is the *Ninth* in order (as I there rank them) which is particularly conſidered, *pag.* 106. 107. 108. I call it *One*, becauſe he takes it ſo to be; though it might as well be called *Two*. For, as there, ſo here, it conſiſteth of *Two branches*, which are Both Falſe; and each overthrow the other. For if the *Arch of a Quadrant* be equal to the *Aggregate of the Semidiameter and of the Tangent of* 30. *Degrees*, (as he would *Here* have it, in *Chap.* 20. and, *There*, in the cloſe of *Prop.* 27;) Then is it not equal to *that Line, whoſe Square is equal to Ten ſquares of the Semiradius*, (as, *There*, he would have it, in *Prop.* 28. and, *Here*, in *Chap.* 23.) And if it be equal to *This*, then not to *That*. For *This*, and *That*, are not equal: As I then demonſtrated; and need not now repeat it.

The grand Fault of his Demonſtration (*Chap.* 30.) wherewith he would now New-vamp his old Falſe quadrature; lyes in thoſe words *Page* 40. *line* 30, 31. *Quod Impoſſibile eſt niſi* ba *tranſeat per* c. which is no impoſſibility at all. For though he firſt bid us *draw the Line R c*, and afterwards the *Line R d*: Yet, Becauſe he hath no where proved (nor is it true) that *theſe two are the ſame Line*; (that is, that the point *d* lyes in the *Line R c*, or that *R c* paſſeth through *d*:) His proving that *R d cuts off from* ab *a Line equal to the Sine of B c*, doth not prove, that *ab* paſſeth through *c*: For this it may well do, though *ab* lye *under* c, (vid. in caſe *d* lye beyond the line *R c*, that is, further from *A*:) or though it lye *above* c, (vid. in caſe *d* be nearer, than *R c*, to the point *A*.) And therefore, unleſs he firſt prove (which he cannot do) that *A d* (a ſixth part of *A D*) doth juſt reach to the line *R c* and no further; he onely proves

that

that a ſixth part of *ab* is *equal* to the Line of *B c*. But, whether it lye *above it*, or *below it*, or (as Mr. *Hobs* would have it) juſt *upon it*; this argument doth not conclude. (And therefore *Hugenius's* aſſertion, which Mr. *Hobs*, *Chap.* 21. would have give way to this Demonſtration, doth, notwithſtanding this, remain ſafe enough.)

His demonſtration of *Chap* 23. (where he would prove, that *the aggregate of the Radius and of the Tangent of* 30. *Degrees* is equal to *a Line, whoſe ſquare is equal to* 10 *Squares of the Semiradius*;) is confuted not only by me, (in the place forecited; where this is proved to be impoſſible;) but by himſelf alſo, in this ſame Chap. *pag.* 59 (where he proves ſufficiently and doth confeſſe, that this demonſtration, and the 47. *Prop.* of the firſt of *Euclide*, cannot be both true.) But, (which is worſt of all;) whether *Euclid's* Propoſition be Falſe or True, his demonſtration muſt needs be Falſe. For he is in this Dilemma: If that Propoſition be *True*, his demonſtration is *Falſe*, for he grants that they cannot be both True, *page* 59 *line* 21. 22. And again, if that Propoſition be Falſe, his Demonſtration is ſo too; for *This* depends upon *That*, *page* 55. *line* 22 and therefore muſt fall with it.

But the Fault is obvious in *His Demonſtration* (not in *Euclid's Propoſition*:) The grand Fault of it (though there are more) lyes in thoſe words, *page* 56. *line* 26. *Erit ergo M O minus quam M R* Where, inſtead of *minus*, he ſhould have ſaid *majus*. And when he hath mended that Error; he will find, that the *major* in *page* 56. *line penult*, will very well agree with *majorem* in *page* 57. *line* 1 (where the *Printer* hath already mended the Fault to his hand) and then the *Falſum ergo* will vaniſh.

His Section of an Angle *in ratione data*; *Chap.* 22. hath no other foundation, than his ſuppoſed *Quadrature* of *Chap.* 20. And therefore, that being falſe; this muſt fall with it. It is juſt the ſame with that of his 6. Dialogue. *Prop.* 46. which (beſides that it wants a foundation) how abſurd it is, I have already ſhewed; in my *Hobbius Heauton timor. page* 119. 120.

His *Appendix*, wherein he undertakes to ſhew a Method of finding *any number of mean Proportionals, between two Lines given*: Depends upon the ſuppoſed Truth of his 22. Chapter; about *Dividing an Arch in any proportion given*: (As himſelf profeſſeth: and as is evident by the Conſtruction; which ſuppoſeth ſuch a Section.) And therefore, that failing, this falls with it.

And yet this is otherwiſe faulty, though *that* ſhould be ſuppoſed True. For, In the firſt Demonſtration; *page* 67. *line* 12. *Producta L f incidet in I*; is not proved; nor doth it follow from his *Quoniam igitur*.

In the ſecond Demonſtration; *page* 68. *line* 34 35. *Recta L f incidit in x*; is not proved; nor doth it follow from his *Quare*.

In his third Demonſtration; *page* 71: *line* 7. *Producta* Y *P tranſibit per* M; is ſaid *gratis*; nor is any proof offered for it. And ſo this whole ſtructure falls to the ground. And withall, the *Prop.* 47. *El.* 1 doth ſtill ſtand faſt (which he tells us, *page* 59, 61, 78. muſt have Fallen, if his Demonſtrations had ſtood:) And ſo, *Geometry* and *Arthemetick* do ſtill agree, which (he tells us, *page* 78: *line* 10.) had otherwiſe been at odds.

And this (though much more might have been ſaid,) is as much as need to be ſaid againſt that Piece.

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